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PENES OF LIBELLULA, ETC.—KENNEDY.

ENTOMOLOGICAL NEWS

AND

PROCEEDINGS OF THE ENTOMOLOGICAL SECTION

THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA

VOL. XXXIII FEBRUARY, 1922 No. 2

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The Morphology of the Penis in the Genus Libellula (Odonata).[1]

By CLARENCE HAMILTON KENNEDY, Ohio State University, Columbus.

(With Plates II and III.)

The writer has just recently undertaken to trace out the phylogeny of the genus *Libellula* through a study of the penes. In this study it was found that this organ was more complex and varied than was generally supposed. It was found that the internal anatomy of the penis was different from the previously published ideas on the subject. This article will confine itself to the morphology of the penis and the homologies of its parts, while the phylogeny of the genus will be dealt with in the second article.

The leading articles on this subject are by Rathke, Goddard, Thompson, Schmidt and Bartenef.[2] Except the last author,

[1] Contribution from Department of Zoology and Entomology of Ohio State University, No. 65.

[2] See the bibliography at the end of this article.

these have attempted to cover too much ground, as the penis is very different from genus to genus.

Studies of the developing naiad [3] indicate that the penis in the Anisoptera is an outgrowth of the anterior end of the sternum of abdominal segment 3. It is flask-shaped. The inflated base attached to the sternum, represents the body of the flask, while the shaft and many lobed tip represent the neck of the flask. See Plate II, fig. 4, which is the penis of *Libellula composita*. The *Libellula* penis is divided into three segments by two flexible joints. Segment 1 is the inflated base, segment 2 the short shaft, which bears a short spur on its dorsal apical end, while segment 3 is the distal portion, which contains the seminal vesicles and meati and which bears at its apex an assortment of lobes. In the Libellulinae the apex of the penis may bear as many as nine lobes, which are so modified from genus to genus that it is difficult in some instances to figure out their homologies. The first half of this article will concern itself largely with these lobes.

THE EXTERNAL ANATOMY of the penis has been discussed by Miss Goddard, by Schmidt and by Bartenef. Schmidt did not name the parts. Miss Goddard named them but Bartenef's terms,[4] though later, are so much more apt that they have been followed in this paper. The latter author used the penis in his monographic revision of the genus *Sympetrum*, so the present writer has begun this study by showing how Bartenef's terms apply to the penis of our own *Sympetrum semicinctum*. See Plate II, figs. 1 and 2. In this species all the lobes are about equally developed, which may be a primitive character. The only species of *Libellula* in which a similar condition exists is *semifasciata* on account of which condition the writer has considered *semifasciata* to be our most ancient *Libellula*. The individual lobes will be discussed as follows:

Lateral lobes (marked *L* in all the figures). These are the outer and most conspicuous pair of lobes and are usually heavily chitinized. In *Sympetrum semicinctum*, Plate II, figs. 1 and 2, they are flattened cylinders as also in *Libellula angelina*, Plate II, fig. 7. In *semifasciata*

[3] Thompson, Backhoff.

[4] Bartenef. Fig. 9, p. 24, Libellulidae, Ins. Neur. Faune Russe.

they are linear, Plate II, fig. 5, in *depressa* forked, Plate II, fig. 12, while in *Orthemis* they are broad flat lobes, Plate II, fig. 13. These lobes are usually easily identified and are the starting point for the identification of the others.

Medial lobes (marked *M* in all the figures). These lie entad and cephalad of the lateral lobes, or dorsad from them if the penis is straightened out. These are usually unchitinized and are not always easily identified until the distal meatus of the seminal vesicles is located. These lobes are the two lips guarding the distal (or apical) meatus. In *lydia*, Plate III, fig. 16, there is a secondary or inner pair of medial lobes within the outer, larger pair. The medial lobes are usually unchitinized and are somewhat erectile. In *jesseana*, Plate III, fig. 26, they are covered with papillae when erect. In *depressa*, if correctly identified, they are chitinized with free ends, Plate II, fig. 12.

Cornua (marked *C* in all the figures). These are very conspicuous in many species of *Sympetrum* but are frequently highly modified in *Libellula*. In *Sympetrum* they are a pair, but in *Libellula* a third cornu may exist which then lies between the other two. These are unchitinized, except in 4-*maculata*, and arise at the extreme apex of the penis. The cornua are well developed in the primitive *semifasciata*, Plate II, fig. 5, where the median one is rudimentary, in *saturata*, Plate II, fig. 3, where the right one is asymmetrical, and in *Orthemis*, Plate II, fig. 13. In *Orthetrum*, Plate II, fig. 14, if correctly identified, there seems to be but one. In *composita*, Plate II, fig. 4, *nodisticta*, Plate II, fig. 6 and *incesta*, Plate II, fig. 10, they are probably represented by the apical tooth, as in *composita;* just under the apical tooth are two smaller teeth which may be homologous to the lateral cornua. In *jesseana*, Plate III, figs. 26 and 27, this median cornu is drawn out into a long tail. In *angelina*, Plate II, fig. 7, the cornua are flattened, which specialization is carried much farther in *Plathemis*, Plate II, fig. 11, and Plate III, fig. 16.

Internal lobes (marked *I* in all the figures). These occur in *Sympetrum* but are usually not conspicuous in *Libellula*, unless they are homologous with the part marked *I* in the figures of *jesseana*, Plate III, figs. 26 and 27. These parts are very erectile and are usually withdrawn quite completely in the dried penis.

Posterior lobe (marked *P* in all the figures). This is an unpaired, very erectile lobe arising on the posterior or ventral surface. It shows in cross section in Plate III, fig. 21. It is retracted and not visible in Plate III, fig. 16. It is fully erect in Plate III, fig. 26, of *jesseana*.

The least specialized penis in the genus *Libellula* is that of *semifasciata*. A comparison of Plate II, figs. 1 and 5, will show that it is remarkably like the penis of *Sympetrum*. However, in the various branches of the genus *Libellula* some very high specializations have come about. The cornua of the *saturata* group are fringed, while those of the two *Plathemis* are short and broad. The apex (cornua?) of the

fulva penis is inflated, Plate II, fig. 9. The lateral lobes in *Plathemis* are paddle-shaped and the medial lobes of *incesta* and *jesseana* are covered by a prominent chitinous hood, Plate II, fig. 10, and Plate III, fig. 26. In the *composita* series, including *incesta, jesseana,* etc., the various soft lobes are very erectile and are covered with a plush of erectile hairs. See Plate III, fig. 26.

The homologies of these various lobes will be more apparent in the figures of the second article where a larger series of species is figured.

THE INTERNAL ANATOMY of the *Libellula* penis is illustrated in Plate III. The most of this part of the study is based on the penis of *Plathemis lydia* because the writer happened to have material of that species that could be sectioned. Fig. 16 shows the adult *lydia* penis in ventral and lateral views. Fig. 17 is a diagram, in shadows, of the penis of a last instar naiad, as this organ lies in its temporary, larval sulcus at the anterior end of the sternum of abdominal segment 3. In this stage the apex (penis segment 3) of the penis is fully developed but the shaft (segment 2) and the inflated base (segment 1) are still only partially developed and are wholly unexpanded. By comparing fig. 17 with fig. 16, the difference between the two stages can be seen. The vertical lines indicated by letters in fig. 17 locate the levels of the sections shown in figs. 18-25, each of which bears a letter to correspond with its level on fig. 17.

The internal anatomy of the *Libellula* penis is simple. In its adult condition it is merely a bag of cuticula lined with a layer of hypodermis and containing, besides two tracheae, the remains of the embryonic tissue which filled its cavity during its development. Apparently this tissue breaks down at the emergence of the naiad, so that in the imago the penis interior is a cavity continuous with the haemocoele of the body. Probably erection of this organ is due to a sudden surge of blood from the abdomen into this cavity. Fig. 25 is a cross-section through the embryonic penis shown in fig. 17 at the level H, and shows the connection of the embryonic tissue of the penis cavity and the haemocoele of the abdomen. This is before the embryonic tissue has disappeared.

The penis has two external openings, one at the apex, between the medial lobes, which I have termed the distal meatus, and one at the outer end of the penis, which I have termed the

proximal meatus. See fig. 16, *dm* and *pm*. Williamson was the first to point out that the penis had two openings. He has figured these for *Desmogomphus*.[5] In the naiad both meati face ventrad, as shown in fig. 17. At the emergence of the naiad into imaginal life the penis bends at the level of the proximal meatus, so that this meatus faces cephalad in the adult. The distal meatus is guarded by the two medial lobes, but the proximal meatus lies fully exposed on the outer bend of the penis.

In *Desmogomphus*, Williamson uses the old terminology and calls the inflated base the "vesicle." Distad to this are three other joints, which he terms first, second and third, the apical segment being the "third." As the "vesicle" of the old terminology is merely the inflated base of the penis, this becomes segment 1, as I have named the parts in this article, so that the *Desmogomphus* penis has four joints where the *Libellula* penis has but three. The segments still homologize in the two penes. Segment 4 of the *Desmogomphus* penis is merely the region of the distal meatus drawn out into a small apical segment not found in *Libellula*. Segment 3 of the penis of *Libellula* equals segments 3 and 4 of the *Desmogomphus*.

The two meati are connected by a tube, which is marked *T* in fig. 17. At either end this tube is dilated into a vesicle. The distal vesicle, *dv* in fig. 17, lies just within the tip of segment 3. The proximal vesicle, *pv* in fig. 17, lies exactly in the flexible outer bend of the (adult) penis. In the *Libellula* penis these openings and vesicles do not connect with the cavity or inflated base of the penis. The true seminal vesicle is this pair of connected pockets in the apex of the penis and not the inflated base of it, as has hitherto been supposed. Just how these apical vesicles and meati function can be only surmised in our present ignorance of their action. No muscles or other structures inside the penis were found that might operate them. As the proximal vesicle, *pv*, lies exactly in the flexible bend of the penis, its action in filling and emptying is probably directly correlated with the motions of this joint. The distal vesicle, *dv*,

[5] A new Gomphine genus from British Guiana. Occ. Papers No. 80, Mus. Zool. Univ. Mich., 1920.

might be emptied by a crushing in of the erectile lobes on the end of the penis when this organ is inserted into the female. Because of the hard, heavily chitinized wall of the penis on the side opposite the lobes, any pressure on these would tend to flatten and empty the apical vesicle. The tube connecting the two vesicles suggests that one is efferent and the other afferent.

Because the penis of the adult dragonfly contains such flinty chitin, the sections of this organ were made from an individual in the last naiadal instar. By taking the naiad just before emergence, the outer cuticula peels off easily, leaving a soft insect that the razor can slice. While the embryology of the penis was not studied, it is probably true that the vesicles in the tip are invaginations of the body-wall of the penis tip. They are lined with chitin and in this final stage they each contain two cuticular exuviae, so that one may legitimately infer that the vesicles exist in the penis during the last three instars of the naiad. The sections figured on Plate III are all of *lydia* except figs. 28 and 29, which are of *incesta*. The figures are drawn to show only outlines and cavities. Each, to be understood, should be referred by the reader back to its proper level in fig. 17, where, as mentioned above the level of each section is indicated by a letter corresponding to that of the figure of the section.

Fig. 18 is section *A* through the bases of the cornua and the lateral lobes. The ridges on the outer sides of the cornua are the distal ends of the medial lobes.

Fig. 19 is section *B* through the bases of the cornua and the lateral lobes.

Fig. 20 is section *C* and shows the distal meatus and a small slice, *dv*, through the apical end of the distal seminal vesicle.

Fig. 21 is section *D* through the distal vesicle, *dv*, and the distal meatus, *dm*.

Fig. 22 is section *E* through the seminal tube, *T*, which connects the two vesicles. It shows also a thin slice across the proximal end of the distal vesicle, *dv*.

Fig. 23 is section *F* showing the seminal tube, *T*, and the tracheae, *tr*. This figure also shows a cross section of the inflated base, *bse*, and a portion of the sulcus of the sternum. It shows also the ventral diaphragm which is muscular where it attaches to the body wall. This diaphragm is well developed in the region of abdominal segments 2 and 3

and may have to do with forcing the blood into the penis when the latter is erected.

Fig. 24 is section *G* through the proximal vesicle, *pv*, and the proximal meatus, *pm*. It shows also the wrinkled and unexpanded condition of the penis shaft.

Fig. 25 is section *H* through the proximal meatus and below the proximal vesicle. It also passes through the attachment of the penis to the sternum and shows the tissue of the body-cavity continuous with the penis cavity. The author has found no actual opening from the abdomen into the base of the penis but he has had only dried and poor material to work with. It is of course remotely possible that the Libellula penis is never truly erected, that the erections produced by boiling the specimens, as in fig. 26, may be wholly unnatural.

In the series of species beginning with the primitive *composita* and terminating in such specialized forms as *vibrans* and *incesta*, the softer parts of the penis are covered with a dense plush of hairs, which become erect when the penis is distended. These can usually be demonstrated by boiling the penis, if the material is not too old. Fig. 27 shows the penis of *jesseana* relaxed and fig. 26 the same organ after boiling, when it is supposedly erect. Fig. 28 is a cross-section through the penis of *incesta* at the line shown in fig. 10 and marked *sec*. Fig. 29 is the upper part of fig. 28 enlarged. The erectile hairs shown in these figures are hollow outgrowths of the soft cuticula and fill and become erect when the main organ is distended. At that time they are distended and their membraneous base is evaginated, so that the boiled *incesta* penis appears somewhat as does the erect *jesseana* penis. When the penis is relaxed these hairs are so completely withdrawn that their presence may be entirely unsuspected.

This paper has shown how little is known definitely concerning the genitalia in the Odonata. The next paper will show how useful the genitalia are in indicating the relationships within the genus *Libellula*.

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EXPLANATION OF PLATES II AND III.

PLATE II.

Figs. 1-2. *Sympetrum semicinctum* (Say). Sunnyside, Washington. Lateral and ventral views of the apical segment of the penis.

Fig. 3. *Libellula saturata* Uhler. Phoenix, Arizona. Penis, ventral view.

The following, except fig. 11, are lateral views of the penis.

Fig. 4. *Libellula composita* (Hagen). Laws, California.

Fig. 5. *Libellula semifasciata* Burm. Pungo Lake, North Carolina.

Fig. 6. *Libellula nodisticta* Hagen. Laws, Owens Valley, California.

Fig. 7. *Libellula angelina* Selys. Kioto, Japan. Coll. of Ris.

Fig. 8. *Libellula 4-maculata* Linn. Grodno Government, Poland. From Bartenef.

Fig. 9. *Libellula fulva* Muell. Arles? From Morton.

Fig. 10. *Libellula incesta* Hagen. (No locality). From O. S. U. coll.

Fig. 11. *Libellula subornata* (Hagen). Golconda, Nevada. Apex of penis viewed from the inner dorsal side with the lateral lobes spread. Enlarged. See Plate III, fig. 16 of *lydia*.

Fig. 12. *Libellula depressa* Linn. Lublin Government, Poland. From Bartenef.

Fig. 13. *Orthemis ferruginea* (Fabr.). Atoyac, Vera Cruz, Mexico. Coll. O. S. U.

Fig. 14. *Orthetrum caerulescens* (Fabr.). North Wales. From Morton.

Fig. 15. *Thermorthemis madagascarensis* (Ramb.). Madagascar. Coll. O. S. U.

PLATE III.

Figs. 16-25. *Libellula lydia* (Drury). Columbus, Ohio.

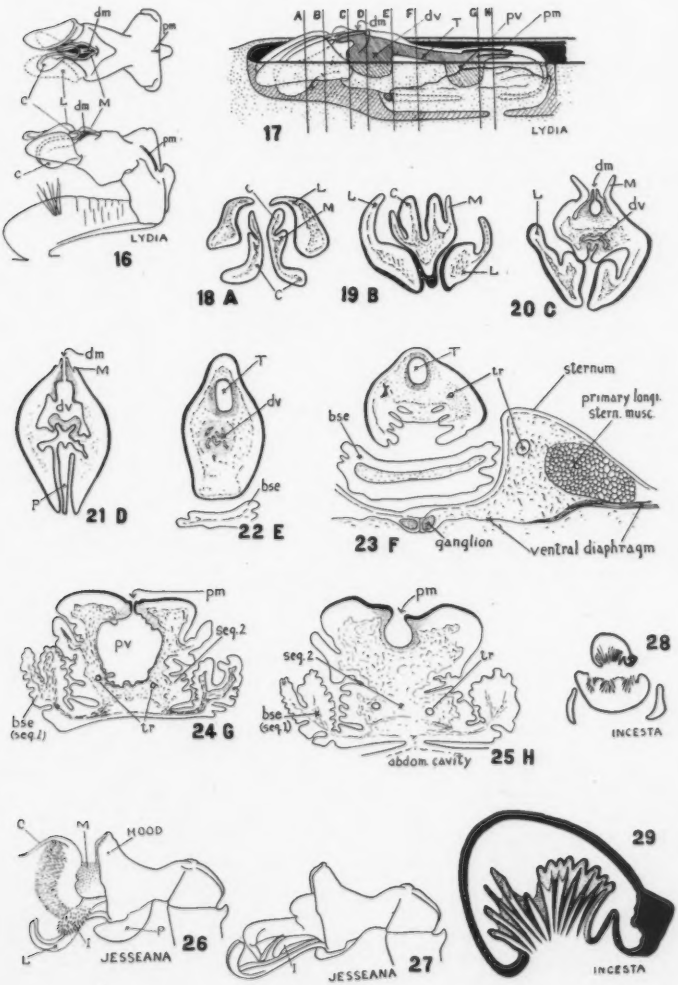
Fig. 16. Ventral and lateral view of adult penis.

Fig. 17. Lateral view of penis of the last naiadal instar drawn in shadow.

Figs. 18-25. Cross-sections at the levels indicated in fig. 17 by the lettered lines.

Figs. 26-27. *Libellula jesseana* Willsm. Enterprise, Florida. From coll. Williamson. Fig. 26 is erected by boiling.

Figs. 28-29. *Libellula incesta* Hagen. Kingsboro, North Carolina. Cross-section of penis showing the erectile hairs.



PENES OF LIBELLULA.—KENNEDY.

Hemipterological Notices.—II.[1]

By H. M. Parshley.

The Pentatomoidea of Illinois.[2]

For many years C. A. Hart devoted a great deal of attention to the Pentatomoid Hemiptera and had nearly completed his manuscript when death overtook him in the midst of his labors. His work has not been lost, however, for Professor J. R. Malloch, the dipterist, saw to its final preparation and publication, thus putting greatly in his debt all who take an interest in the group, and as editor he added a considerable amount of supplementary matter (always carefully indicated as such), which in the main possesses distinct value. The paper as a whole contains a great deal of new and important material, especially some excellent pioneer work in the neglected study of the nymphal stages, an introductory discussion of phylogeny, and generic keys which are not confined to the Illinois fauna, but embrace most of the North American groups. In going over the work I have noted a few matters which call for comment.

Page 180. The editor remarks on the curious results achieved by Hart in his effort to arrange his keys so as to indicate natural sequence. Such a plan usually results in defeating the prime purpose of a key, *i. e.*, ready identification, since obscure characters often have to be used. I think that the arrangement both of genera and higher groups should be ignored, in favor of that given in Van Duzee's "Catalogue."

Page 192. I am unable to accept Malloch's splitting of *Euschistus tristigmus* into two (or three?) species. Like some other Pentatomids, this species is variable in the form of the lateral pronotal angles and no line can be drawn distinctly separating the acutely angled forms (var. *pyrrhocerus* H.-S.), which become more frequent in the southern states. Possibly a tendency toward racial development may be found here when sufficient distributional data are made known. Similarly, fig. 79

[1] Contributions from the Department of Zoology, Smith College, No. 83.

[2] Ill. Nat. Hist. Survey, Bull. xiii, 157-223, pls. 16-21, 1919.

of pl. 21 probably represents the southern form of *Thyanta custator,* another variable species, and not *T. perditor,* which is a species of the tropical zone. Barber (*in litt.*) calls my attention to this point.

Pages 199-200. In Hart's treatment of *Apateticus* the species *crocatus* and *bracteatus* are confused. The facts will be correctly expressed if the names are transposed, except that Van Duzee is misquoted.

Pages 218-219. The editor contributes a supplement in which Stål's subgenera of *Apateticus* are elevated to generic rank. I am firmly convinced that a great deal of the modern multiplication of genera (by subdivision rather than by the discovery of new groups) is a detriment rather than an advantage to science, but aside from this general question it should be noted that in this particular case nothing can be settled properly without a study of the neotropical species. For instance, the type species of *Apateticus* Dall. is *A. halys* Dall. (= *lineolatus* H.-S.), a species which, as I have identified it, lacks the one character ascribed by Malloch to his *Apateticus.* This character, the presence of small pronotal spines near the basal angles of the scutellum, is not mentioned by Dallas[3] nor by Stål,[4] but it is found in *A. marginiventris,* to which reference is made below. In other words it seems unlikely that *Apateticus* Mall. is precisely equivalent to *Apateticus* Dall.

I think moreover that it is even very doubtful whether the generic separation of *Apateticus* and *Podisus* advocated by Van Duzee[5] is well founded, since the chief distinction between the groups lies in a secondary sexual character, the abdominal stridulatory areas which are more or less clearly developed in the males of *Apateticus, s. str.* I believe that the arrangement of Stål and of Schouteden[6] will be ultimately adopted, with possibly one modification, namely the foundation of a new subgenus for *A. marginiventris* Stål, a species which is unique in this group by virtue of its posterior pronotal spines and its very peculiar facies.

[3] List Hem. Brit. Mus. 1:105, 1851.
[4] Bidr. Hem. Syst., Ofv. Vet.-Ak. Förh., XXIV, No. 7:498, 1867.
[5] Can. Ent., XLI:370, 1909.
[6] Wyts. Gen. Ins., Fasc. 52:68, 1907.

AN OMISSION.

In my "Essay"[7] on *Aradus* I have noted a few clerical errors, only one of which, fortunately, is of importance. On page 41 the Rhode Island and Connecticut records of *Aradus robustus* are omitted and the following should be inserted after line 9:

RHODE ISLAND: Kingston, May (J. Barlow). CONNECTICUT: Meriden, V, 10, 1910 (A. B. Champlain); New Haven, II, 26, 1911 (A. B. Champlain); Rainbow, V, 7, 1914 (M. P. Zappe); Stonington, V, 1914 (M. P. Zappe).

On page 29, line 16, for p. 17 read p. 50; and on pages 32, 66, etc., Ottawa is placed in Quebec instead of in Ontario.

DISTRIBUTIONAL AND TAXONOMIC NOTES.

COREIDAE.

Namacus annulicornis Stål. Arcadia, Florida, November 23, 1919 (H. L. Johnson).

ARADIDAE.

Proxius gypsatus Bergroth. Manning, South Carolina, March 28-29, 1919 (E. R. Kalmbach).

Neuroctenus pseudonymus Bergroth. Clarksville, Tennessee, March 26, 1909 (S. E. Crumb).

Aneurus simplex Uhler. Proc. Boston Soc. Nat. Hist., XIV:196 1871.

Lectotype: ♂, Mass., U. S. N. M. No. 25213. This specimen bears Uhler's original label and should be formally designated as the type of the species, especially in view of the very inadequate original description, which refers only to the antennal structure and to the granulation of the surface. A female specimen with the same data is designated allotype.

A New Genus in the Gelechiidae (Microlepidoptera).

By ANNETTE F. BRAUN, Cincinnati, Ohio.

STEREOMITA new genus.

Head smooth, antennae nearly equaling the fore wings, basal segment long, slender, stalk somewhat serrate toward tip. Labial palpi long, recurved, second segment thickened with scales beneath and slightly tufted, third segment equaling the second, thickened with scales in the middle and acute at extreme apex. Maxillary palpi short, appressed to tongue. Posterior tibiae with rough hairs above and in the middle beneath, middle spurs from before basal fourth of the segment.

Fore wings narrow, lanceolate-acuminate; 11 veins, 1b fur-

[7] Trans. Am. Ent. Soc., XLVII: 1-106, 1921.

cate at base, 2 and 3 coincident from the angle, arising nearly opposite 9, 4 and 5 connate, nearer 6, 7 and 8 out of 6, 9 distant, 11 from beyond middle. Hind wings ½, a little narrower in the male, with anal angle less distinct, termen emarginate, apex produced; all veins present, 2, 3, 4 and 5 remote, 5 nearest 6, 6 and 7 very short stalked.

Genotype: *Stereomita andropogonis* n. sp.

Allied to *Metzneria* and *Megacraspedus,* but distinguished by the absence of a vein in the fore wing, and by the thickened third segment of the labial palpi.

Stereomita andropogonis n. sp.

Head whitish straw-colored, palpi straw-colored, with a dark brown patch near apex of second segment outwardly, and a dark brown annulus around middle of third segment. Antennae pale ocherous, with a narrow brown annulus at the base of each segment, and four broader blackish rings on the outer half of the stalk, separated from one another by two or three pale segments. Fore wings pale ochreous, deepest toward apex, and dusted with dark brown scales, most densely on the costal and dorsal margins with a tendency to longitudinal streaking; at two-thirds of costa, the dusting usually forms two diffuse oblique streaks. Along termen, there is a series of indistinct brownish dots, and opposite extreme apex, in the cilia, a transverse brownish spot. Cilia brownish, except on costa before apex, where they are ocherous. Hind wings pale brown, cilia ocherous, with a faint reddish tinge. Legs ocherous, dusted with brown. Wing expanse: 8.5-9.5 mm.

Type (♂) and 32 paratypes, Miamiville, Clermont County, Ohio, August 19 and 25. Type and paratypes in the writer's collection; paratypes in the collection of the Academy of Natural Sciences of Philadelphia and in the U. S. National Museum.

The larvae feed in the inflorescence of *Andropogon scoparius* (bear-grass.) Their presence is indicated by yellowish patches in the flower spikes.

The moths are active in early morning and in the evening, flying at the top of the stems around the flower buds, and alighting head downward. During the middle of the day they rest amongst the basal leaves and are only disturbed with difficulty. In markings of wings, palpi and antennae, and in general appearance when at rest, this insect remarkably resembles some species of *Batrachedra.*

New Researches upon the Problem of the Wing-Venation of Odonata.

I. A Study of the Tracheation of the Larval Wings in the Genus Uropetala from New Zealand

By R. J. TILLYARD, M.A., Sc.D. (Cantab.), D.Sc. (Sydney), F.L.S., F.E.S., Entomologist and Chief of the Biological Department, Cawthron Institute, Nelson, New Zealand.

(Continued from page 7)

We may now ask, what position does the family *Petaluridae* hold in the evolutionary line of the Odonata, and what are the successive stages in the evolution of the vein Ms? These questions can be very clearly answered, as follows:—

(A) The first true Odonata had entirely lost their original *Rs* as a distinct branch of *R*. I shall show later, from a study of the Palaeodictyoptera and Protodonata, that this original *Rs* arose from *R* close to the base of the wing, as in other archaic types of insects, and that it was captured and cut off from *R* by an upwardly arching branch of *M*, of the type found in many Palaeodictyoptera and in all Orthopteroidea. The vein so formed, after its severance from *R*, had the appearance of a *six-branched media*; but one of the original branches, *M1a*, has become degraded in the highest forms of Odonata, leaving us with only *five* recognizable main branches. The best designation for this composite vein would be the *radio-median*, with the notation RM; but I do not propose to adopt this new notation until I have fully established, from the fossil record, the proof of its complete nature.

(B) This original condition, which became established with the rise of the Protodonata, is continued to the present day, without change, into the whole of the Order Zygoptera, with the single exception of the *Lestidae*. In all living forms which have this primitive condition, *the larval tracheation of this portion of the wing agrees exactly with the subsequent imaginal venation;* and this, I take it, is additional proof, if such is needed, that neither the tracheation nor the venation of this portion of the wing, in these insects, has ever become specialized.

(C) Arising from somewhere low down in the Megapodagrionine stem, we find the first tracheational specialization still in process of becoming established, in the subfamily *Synlestinae* of the *Lestidae*. In these archaic insects, whose close affinity with the still more ancient *Megapodagrioninae* admits of no doubt whatever, we find that, *in most larvae* (the genus examined was *Synlestes*), there is a complete formation of long bridge and distal oblique vein *O'*. This has been brought about by one of the small tracheae descending from *M2*, far distad from the nodus, capturing the line of the vein *Ms*, so that the original trachea which supplied this vein from its base on *M3* outwards becomes withered, leaving the apparent *long bridge-vein* as the basal half of *Ms*. Also, *Synlestes* still shows the archaic position of the origin of *Ms*, viz., from *M3*, though most recent Zygoptera have *Ms* arising from *M1+2*. But, in a certain number of these larvae of *Synlestes*, one or more of the wings may retain the original Megapodagrionine condition, *i. e.*, there is no trachea forming the oblique vein, which, consequently, is absent in the imago.

In the subfamily *Lestinae*, the oblique vein and long bridge have become completely established. An exactly similar formation is to be seen in the *Epiophlebiidae*, and also in the fossil genus *Heterophlebia*, which is closely allied to this family. Both *Epiophlebia* and *Heterophlebia* are to be considered as belonging undoubtedly to Handlirsch's Suborder Anisozygoptera, the discovery of the larva of the former genus making the recognition of this Suborder a necessity, as I have shown in a previous paper.[4]

(D) For the next step, we must postulate an origin for the Suborder Anisoptera from forms among the Anisozygoptera in which the distal oblique vein and long bridge were fully established. *Heterophlebia* may not have been the true ancestor of the Anisoptera, but there can be little doubt that it represents very closely what that ancestor was like, at the stage of the first formation of the triangle in the hind wing. Starting

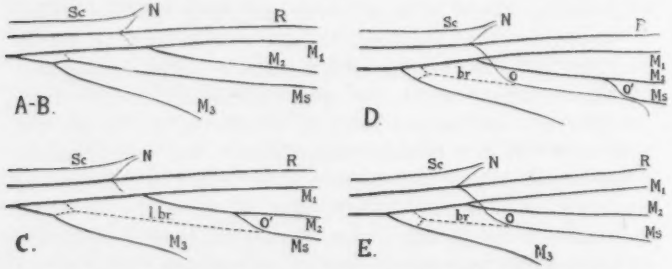
[4]Tillyard, R. J. "On an Anisozygopterous Larva from the Himalayas (Order Odonata). Records Indian Museum, 1921, xxii, pt. ii, no. 12, pp. 93-107, pl. xiii.

with an ancestral form of this type, the true Anisoptera began with forms in which the point of origin of *M2* became fixed close under the nodus. The small trachea beneath the nodus, arising from *R*, and supplying the subnodal vein, must next have grown out as a very slender branch beneath *M*1 and *M*2, just beyond their point of union, and must have at last found its way down to the level of *Ms* at about the middle of the long bridge. There being no trachea supplying the long bridge, it is not difficult to see how this new trachea came to supply its distal half. With a very slight increase in the development of this trachea, we get the stage represented in the antepenultimate instar of the larva of *Uropetala*, in which the calibre of the new tracheal outgrowth is still much smaller than that of *Ms*. Further increase in calibre would give us the present condition in the last instar of *Petaluridae*, in which the trachea from the subnodus underlies the basal oblique vein *O*, and supplies also that portion of *Ms* between *O* and *O'*. I would suggest that the notation *Rs* for this trachea should be definitely abandoned. As it is a tracheal outgrowth from *R* below the nodus, it should be called the *subnodal trachea*, while the notation *Ms* should be kept for the whole vein. If it is desired to distinguish the three portions of the vein Ms in *Petaluridae*, we might speak of the *bridge* or *basal portion*, the *subnodal* or *middle portion*, and the *distal portion*, respectively.

Thus we see that the *Petaluridae* stand as the oldest type extant within the Anisoptera, possessing *two* tracheal specializations in the region of *Ms;* one, indicated by *O'*, being derived from Anisozygopterous ancestors, and being homologous with that seen in the *Lestidae* and *Epiophlebiidae;* while the other, indicated by *O*, is peculiar to the Anisoptera, and is to be considered as of later origin.

(E) If we examine the *Cordulegasteridae*, which show affinity with the *Petaluridae* on the one hand and with the *Aeschnidae* and *Gomphidae* on the other, we find occasional specimens in which the two oblique veins of the *Petaluridae* are present. But, in most cases, only the basal oblique vein *O* is present, with a short bridge-vein. Thus, in this family, we see the dying out of the original tracheal specialization indi-

cated by *O'* and the long bridge; the trachea which first captured the line of *Ms* via *O'* becomes ousted by the subnodal trachea, and the result is that we get the formation seen in the larvae of almost all Anisoptera at the present day, viz., a single oblique vein *O*, placed not far distad from the level of the nodus, a short bridge vein, and *an apparent trachea Rs* supplying the course of the vein *Ms*.



Text-fig. 2.—Diagrams to show the evolutionary stages in the region of the nodus and oblique veins in Odonata. A-B, the primitive condition, in which the imaginal venation corresponds with the larval tracheation, and no oblique veins are present. C, formation of the long bridge and distal oblique vein, as in Lestidae. D, condition seen in Petaluridae, with short bridge and two oblique veins. E, condition present in the majority of Anisoptera, with short bridge vein and only the more basal oblique vein present.

Text-fig, 2 shows the tracheation of the larval wing for each of these evolutionary stages.

If this outline of the evolution of this portion of the larval and imaginal wings be accepted, we must recognize the Zygoptera and the Anisozygoptera as the first two Suborders to appear by differentiation of the original Odonate stock, and we must allow that the Anisoptera only arose later, from some of the more specialized types among the Anisozygoptera. That this was actually so, I believe can be fully proved by a careful study of the known fossil record, as I shall endeavor to set out in a later part of these researches.

We have now to deal briefly with one line of criticism that will most certainly be levelled against the position taken in this paper. In his original paper (1), Needham gave drawings of the positions of his supposed trachea *Rs* in the developing stages of the larva of a species of *Gomphus*. No photographs were given of any but the last instar. In these drawings, it

was shown that, in the very earliest stages, *Rs* lay in its normal position below *R*, without crossing *M* at all. At a somewhat later stage, *Rs* was shown crossing *M*1 only. Later still, *Rs* was shown crossing both *M*1 and *M*2.

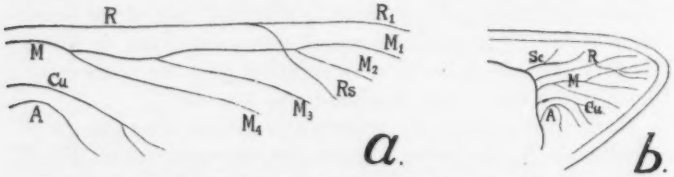
If these drawings represent the correct postion of *Rs*, they do most certainly constitute a strong argument for Needham's view. Quite apart from the difficult question as to the actual possibility of both a vein and its precedent trachea shifting its position in this manner, it must be admitted that, if the larval wing shows the ontogenetic stages in correct order, it would be very difficult to avoid the conclusion that we were really dealing with the original trachea *Rs* in this case.

Now, I have repeatedly attempted to parallel these figures of Needham's, by dissecting off the earliest stages of the larval wings in various Anisopterous genera; but I have never succeeded in finding any other condition than that in which the supposed *Rs* crosses both *M*1 and *M*2, as it does in the last larval instar. The genera examined by me were *Aeschna, Hemicordulia* and *Diplacodes*. Dr. Ris has also examined the earliest stages of the larval wing in *Libellula,* and his results agree exactly with my own. One of his photographs shows such an early stage of the growth of the larval wing that the extreme length of it is barely half the breadth at the base; yet, in this case, as in the corresponding stages of those genera which I have examined, the supposed *Rs* descends almost transversely across the wing, crossing both *M*1 and *M*2, as in the last larval instar.

There were, therefore, only two possible conclusions to come to. Either the genus *Gomphus* presents a more complete ontogenetic series of the development of *Rs* than do the other genera studied, or Needham's drawings were incorrect.

Recently, during my tour round the world, I visited Ithaca and met Professor Needham. Together we collected larvae of *Gomphus* and *Hagenius* in the creek there, and I decided to dissect the wings of the earliest stages obtainable, and compare them with Needham's own drawings. I must admit that the result came as a great surprise. Text-fig. 3 shows the condition in the two earliest obtainable instars. The instar shown

in Text-fig. 3, *a*, appears to correspond to that which Ris succeeded in obtaining for *Libellula*, and is certainly quite as early a stage as that figured by Needham in which *Rs* is shown not crossing *M* at all. The next instar to this is shown in Text-fig. 3, *b*, and this is certainly either earlier than, or as early as, that in which Needham figures *Rs* as crossing *M*1 only. Several larvae of *Gomphus* in these early stages were dissected, together with one larva of *Hagenius*. All agreed in having the



Text-fig. 3.—*a*, *Gomphus villosipes* Selys, early larvarl instar, tracheation of portion of forewing, greatly magnified. *b*, the same, next succeeding larval instar, complete tracheation of forewing less highly magnified.

supposed *Rs* in the position shown in Text-fig. 3. It is only possible to conclude that Needham's figures of these stages were incorrectly drawn, probably through displacement of the very delicate tracheae.

Thus we may now be sure that no ontogenetic stages of the supposed development of *Rs* really exist in the early larval instars of Anisoptera. The position of this trachea being the same in all instars from the earliest upwards is easily understandable on the theory that it is not the original *Rs*, but an extension of the subnodal trachea, as I have indicated in the argument presented in this paper.

A further objection which has to be met is this:—If this trachea does not represent the original *Rs*, where is the original *Rs*? I have already indicated that the solution of this problem depends upon a study of the known fossils of the Orders Palaeodictyoptera and Protodonata. The solution would take us far beyond the confines of this paper, and is left for a future part of these researches.

I have referred only briefly, in this paper, to the interesting problem of the cubital and anal veins in the Odonata. It is quite clear, from a study of the fossil record, that the present

interpretation of the limits of these veins cannot stand. It has always been a serious difficulty, in studying the homologies of the wing-veins in different Orders, that the vein named *Cu*1 in Odonata was concave, whereas, in all other insects, this vein is a strongly convex vein; and it is equally difficult to explain how the vein called *Cu*2 in the Odonata should happen to be convex, when this vein is, in all other insects, the most concave in the wing, forming, in the Orthopteroid and Panorpoid Orders, the *vena dividens* separating the clavus from the rest of the wing. I hope to show that, in the Odonata, the true *Cu*1, which, in most insects, originates from a compound vein *M*5 + *Cu*1, is the vein which we now call *M*4; also that the vein which we call *Cu*1 in Odonata is in reality the homologue of *Cu*2 in other Orders; and finally that the single anal vein existing in the Odonata is 1*A*, and that it extended originally far along the posterior part of the wing, embracing all except the extreme base of the vein which we now call *Cu*2 in Odonata. Further, the presence of only one anal vein can be explained only by supposing that the original ancestors of the Odonata had a very narrowed base to the wing; and this also I shall be able to demonstrate from the fossil record.

Sufficient has now been said to make it evident that we require a complete re-study of Odonate wing-venation, in order to bring our notation into line with that used in other Orders. If it is found impossible to arrive at any general agreement in this matter, then it would be far better to go back to the non-committal names given by de Selys, rather than to continue to use a notation which gives an entirely false idea of the homologies existing between the veins called radial sector, media, cubitus and first analis in the Order Odonata and those carrying these same names in other Orders.

Entomological Losses by Fire

The home of Dr. Charles P. Alexander, Urbana, Illinois, was destroyed by fire on New Year's morning. The greater part of his collection of crane-flies was saved, this including all but a few types. Duplicate material, both of specimens and reprints, was largely destroyed by fire or water. Reprints that had been sent before by entomologists and can still be duplicated will be very gratefully received. Such may be addressed to him at the Natural History Building, Urbana, Illinois.

A New Cerambycid Beetle from Santo Domingo (Col.).

By W. S. FISHER, U. S. Bureau of Entomology.

Among a small collection of West Indian Cerambycidae received from Mr. J. J. Davis for identification, the following apparently new species was found.

Callichroma domingoensis new species.

♂.—Elongate, subcylindrical and attenuate posteriorly; head, pronotum, elytra and underside except abdomen dull metallic green with a slight violaceous tinge; antennae, tibiae, tarsi and abdomen black; femora entirely of a bright reddish-brown color, and somewhat opaque.

Head deeply longitudinally grooved on vertex. Antennae about one and one-half times as long as the entire body; joints three to eleven strongly, longitudinally carinated.

Pronotum with the medio-lateral tubercle well developed and acute at tip; antero-lateral callosity not strongly marked; strongly constricted anteriorly and along the base, the basal constriction being more shallow than one along anterior margin; disc on each side of median line with a feebly rounded gibbosity just behind the anterior constriction; surface strongly, transversely rugose, with a few distant punctures between the rugae, and sparsely clothed with short black hairs. Scutellum large, triangular, and longitudinally concave; surface smooth at middle and rather densely, finely punctate towards the sides.

Elytra two and one-half times as long as wide; sides very much narrowed from base to tips, which are rather broadly separately rounded; humerus well developed; surface rather deeply, densely and confluently punctate, becoming feebly rugose towards apex, and sparsely clothed with very short, inconspicuous, recumbent black hairs.

Abdomen rather densely, obsoletely punctate and densely clothed with a short, somewhat silvery pubescence; last ventral segment broadly rounded at apex without any trace of a notch.

Front and middle femora short and abruptly petiolate near apex; hind femora slender, compressed, gradually becoming wider to apex and reaching to the tip of the elytra. Front and middle tibiae about equal in length to the femora, slightly compressed and gradually enlarged anteriorly; surface longitudinally carinate, finely, irregularly punctate and clothed with long stiff black hairs. Hind tibiae not quite as long as the femora, moderately broad and strongly compressed; lower surface broadly concave with the inner margin densely clothed with a series of stiff black hairs.

Length 28 mm.; width 8 mm.

Type Locality.—"San Sidro, Santo Domingo." *Type.*—Cat. No. 24676, U. S. National Museum.

Described from a single male specimen received from Mr. J. J. Davis, and collected by Dr. Browne during April or May, 1919, at "San Sidro, Santo Domingo." [San Isidro?].

This species resembles *Callichroma plicatum* LeConte, to a certain extent, but is, however, easily separated from that species by the abdomen being entirely black, pronotum less densely punctured, and the femora being uniformly light reddish-brown in color, and not tipped with black as in *plicatum*.

ENTOMOLOGICAL NEWS

PHILADELPHIA, PA., FEBRUARY, 1922.

Entomology at the Convocation Week Meetings, December, 1921

The meetings of the American Association for the Advancement of Science and of the Associated Scientific Societies, held at Toronto, Canada, December 27 to 31, 1921, were highly successful and interesting, well attended and took place under favorable weather conditions, the extreme cold which many feared not having been present. The arrangements for the meetings in the various buildings of the University of Toronto were, in nearly all respects, very convenient and satisfactory. Lunches and many dinners were held in Hart House, that magnificent home of the social activities of students and faculty. To the members of the Local Committees, especially those in charge of the entomological visitors, we extend our heartiest thanks.

Papers relating, in whole or in part, to the tracheate Arthropods were listed on the programs of

A. A. A. S., General Sessions	1
American Society of Zoologists (alone)	20
The same with the Ecological Society of America	2
Entomological Society of America (alone)	16
The same with the Entomological Society of Ontario	15
The same with the Ecological Society of America	18
Ecological Society of America (alone)	1
American Association of Economic Entomologists (alone, but including its Sections on Apiculture and Horticultural Inspection)	55
The same with the Entomological Society of Ontario	19
The same with the American Phytopathological Society, symposium	1
American Society of Naturalists	2
American Nature Study Society	1
American Society for Horticultural Science	1
Total	152

These 152 papers were concerned with the following subjects:

General Entomology 8
Methods 5
Cytology 4
Anatomy 8
Physiology 15
Ontogeny 4
Genetics 8
Taxonomy 6
Ecology 9
Relations to Plants (noneconomic) 2
Parasites (of animal hosts) 9
Relations to Man 5
General Economic Entomology 19
Insects Injurious to Plants 24
Insecticides and Fumigants 18
Apiculture 8
Other Special Insects 10

Araneina 1
Acarina 6
Myriopoda 1
Orthoptera 3
Isoptera 1
Ephemerida 3
Odonata 2
Neuroptera 1
Mallophaga 1
Anoplura 1
Hemiptera 16
Coleoptera 15
Hymenoptera (exclusive of *Apis*) 8
Apis 8
Lepidoptera 25
Diptera (exclusive of *Drosophila*) 19
Drosophila 6
Siphonaptera 1

Many of the figures in this second list are duplicated; thus a paper on the Genetics of *Drosophila* appears under both of these headings.

The paper credited to the general sessions of the A. A. A. S. was the address of the retiring President, Dr. L. O. Howard, entitled, "On Some Presidential Addresses: The War on the Insects," which has been published in *Science* for December 30, 1921.

The symposium of the Economic Entomologists and the American Phytopathological Society was on "Insects as Disseminators of Plant Diseases," in which Dr. E. D. Ball, of Washington, D. C., and Prof. L. Caesar, of Canada, represented the Entomologists.

Included in the above lists are also the Annual Address of the Entomological Society by Dr. Seymour Hadwen, of the United States Biological Survey, on "Northern Oestridae"; the Presidential Address before the Economic Entomologists by Prof. George A. Dean, of Manhattan, Kansas, on "How We May Increase the Effectiveness of Economic Entomology," and a paper read by Dr. L. O. Howard on "The Organization Meeting of the Association of Economic Entomologists, at Toronto, August, 1899." This was "saved" for the very enjoyable

Entomologists' dinner, at the Prince George Hotel, on Friday evening, December 30. At this occasion, Professors J. H. Comstock and Herbert Osborn, guests, with Dr. Howard, of the Association of Economic Entomologists, gave some very interesting reminiscences of early events in their respective careers.

Not included in the lists we have given, but of great interest to entomologists and biologists generally, were three symposia, one by the botanists, "The Species Concept"; one by the Naturalists, "Origin of Variations," and one by the Zoologists, "Orthogenesis." Here too we must mention the addresses by Prof. William Bateson, guest of the A. A. A. S. and of the Zoologists, on "The Evolutionary Faith and Modern Doubt" before a general session of the Association, and on "The Outlook in Genetics" at the Zoologists' dinner.

The total of 152 papers, although, as usual, not all of them were given, is, we believe, the highest ever listed for one of these meetings.

Notes and News.

ENTOMOLOGICAL GLEANINGS FROM ALL QUARTERS OF THE GLOBE

Mulford Biological Exploration of the Amazon Basin News Bulletin No. 5.

The arrival in Philadelphia of a second shipment of scientific specimens from the Mulford Exploration is announced. The H. K. Mulford Company has arranged for their clearance through Customs and, in accord with Dr. Rusby's instructions, has distributed them to specialists of the Universities and Museums who are co-operating in the work of this expedition.

The latest letters received from Dr. Rusby and his party, were written Oct. 21st, 1921, and mailed from Rurrenabaque, Bolivia. Dr. Rusby and his party had at that time started out on the trip to Lake Rocagua and surrounding territory, with the expectation of finding much that was new, including geographical facts as well as biological and botanical specimens. Although all the maps of South America show the Rio Negro as the outlet of Lake Rocagua, their information was that no connection exists between the lake and the river but that the river originated in a low range of hills situated near the lake.

Cable messages since received indicate the successful termination of their trip to Lake Rocagua and progress as far as Riberalta in Bolivia near the Brazilian border. All the members of the party were reported in excellent health and spirits except the director himself. Dr. Rusby has been suffering from infectious rheumatism brought on and heightened by the exposure and hardships of the life in the wilderness. It is probable that on account of the state of his health it may be necessary to abandon the second part of their trip up into Colombia, as contemplated in the original plans.—R. H. HUTCHISON, Secy., Philadelphia, Pa.

The Crop Protection Institute.

The first annual meeting of the Crop Protection Institute will have been held at Rochester, New York, in connection with the New York Horticultural Society's meeting, with a dinner on January 12th, at the Rochester Chamber of Congress.

It was announced that among those taking part on the program would be Professor W. C. O'Kane, of the New Hampshire Agricultural Experiment Station, and Chairman of the Board of Governors of the Crop Protection Institute, who was to talk on the ideals of the Institute; Dr. L. R. Jones, Chairman of the Division of Biology and Agriculture of the National Research Council, whose theme was to be the "Relation of Environment to Disease and Disease Resistance of Plants;" Dr. R. W. Thatcher, Director of the New York Agricultural Experiment Station, who was to speak informally on the "Need for Investigations in the Chemistry of Insecticides and Fungicides." From the standpoint of industry Mr. G. R. Cushman, of the General Chemical Company, was to give a brief talk. Professor P. J. Parrott, of the New York Agricultural Experiment Station, would also probably talk on Paradichlorobenzene.

The Crop Protection Institute, which has a membership of about three hundred and fifty (350) prominent entomologists, plant pathologists, agricultural chemists and manufacturers of insecticides and fungicides and others interested in the protection of all kinds of crops, was organized only a year ago, under the auspices of the National Research Council of Washington, D. C. The purpose of the Institute is not to duplicate the work of individuals or other organizations, but to bring about closer co-operation of effort, to strengthen the weak places and develop needed investigations that are not being pursued by other agencies.

Entomological Literature

COMPILED BY E. T. CRESSON, JR., AND J. A. G. REHN.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species, will be recorded.

The numbers in **Heavy-Faced Type** refer to the journals, as numbered in the following list, in which the papers are published.

All continued papers, with few exceptions, are recorded only at their first installments.

The records of papers containing new genera or species occurring north of Mexico are grouped at the end of their respective Orders.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

The titles occurring in the Entomological News are not listed.

2—Transactions of the American Entomological Society, Philadelphia. **4**—Canadian Entomologist, London, Canada. **5**—Psyche, Cambridge, Mass. **9**—The Entomologist, London. **12**—Journal of Economic Entomology, Concord, N. H. **15**—Insecutor Inscitiae

Menstruus, Washington, D. C. **20**—Bulletin de la Societe Entomologique de France, Paris. **22**—Bulletin of Entomological Research, London. **39**—The Florida Entomologist, Gainesville, Florida. **42**—Entomologiske Meddelelser udgivne af Entomologisk Forening, Kjobenhavn. **48**—Wiener Entomologische Zeitung. **49**—Entomologische Mitteilungen Berlin-Dahlem. **52**—Zoologischer Anzeiger, Leipsic. **54**—Proceedings of the Biological Society of Washington, D. C. **61**—Proceedings of the California Academy of Sciences, San Francisco. **64**—Parasitology, London. **68**—Science, Lancaster, Pa. **76**—Nature, London. **77**—Comptes Rendus des Seances de la Societe de Biologie, Paris. **85**—The Journal of Experimental Zoology, Philadelphia. **87**—Arkiv for Zoologi, K. Svenska Vetenskapsakademien, Stockholm. **90**—The American Naturalist, Lancaster, Pa. **91**—The Scientific Monthly, Lancaster, Pa. **99**—Bulletin du Museum National d'Histoire Naturelle, Paris. **102**—Broteria, Revista Lusco Brazileira, Serie Zoologica, Braga. **104**—Zeitschrift fur Wissenschaftliche Zoologie, Leipzig. **106**—Anales de la Sociedad Cientifica, Argentina, Buenos Aires. **111**—Archiv fur Naturgeschichte, Berlin. **119**—Proceedings of the National Academy of Sciences of the U. S. A., Washington, D. C. **130**—Revista Chilena de Historia Natural. **131**—Annales de Zoologia Aplicada, Santiago de Chile. **132**—Revista do Museu Paulista, Sao Paulo, Brazil.

GENERAL. Bird, H.—Soil acidity in relation to insects and plants. (Ecology, ii, 193 7.) **Cockerell, T. D. A.**—Dru Drury, an eighteenth century entomologist. **91,** xiv, 67-82. **Glendenning, R.**—Notes on the fauna and flora of Mt. McLean, B. C. **43,** No. 18, 39-44. **Hempel, A.**—As pragas e molestias do arroz no estado de Sao Paulo. **132,** xii, 147-50. **Howard, L. O.**—On some presidental addresses: the war against the insects. **68,** liv, 641-51. **Johansen, F.**—Insect life on the western arctic coast of America. (Rep. Canada. Arct. Exped., iii, K, 61 pp.) **Lucas and Strand.**—Jahresberichte uber die wissenschaftlichen leistungen im gebiete der Trichoptera, Mecoptera, rodentia, Odonata, Agnatha...Orthoptera. **111,** 1916, B, 1-19, 171. Neuroptera, Mallophags, Anoplura, Thysanoptera, Plecoptera, Cor- **Porter, C. E.**—Sobre algunos arthropodos colectados en diversas localidades del pais por los senores... Thomas, Campo., etc. **130,** xxiv, 153-60. **Serre, P. A.**—Insectes piquants et parasites au Costa-Rica. **99,** 1921, 170-2. **Weiss and West.**—Additional notes on fungous insects. **54,** xxxiv, 167-71. **Whiting, P. W.**—Rearing meal moths and parasitic wasps for experimental purposes. Heredity in wasps. (Genetics, xii, 255-61; 262-66). **Wildeman, E. de.**—A propos de myrmecophilie. **77,** lxxxv, 874-6.

ANATOMY, PHYSIOLOGY, etc. Bertin, L.—La bouche des insectes et leur alimentation. (La Nature, Paris, 1921, 323-28.) **Brocher, F.**—Etude experimentale sur le fonctionnement du vaisseau

dorsal et sur la circulation du sang chez les insectes. **87,** lx, 1-45. **Courrier, R.**—Sur l'existence d'une secretion intranucleaire dans l'epithelium du spermatheque de la reine d'abeille sa signification. **77,** lxxxv, 941-3. **Crampton, G. C.**—Note on the surginopods of certain Mecoptera and Neuroptera. **5,** xxviii, 151. **Cunliffe, N.**—Some observations on the biology and structure of Ornithodorus moubata. **64,** xiii, 327-47. **Fraenkel, H.**—Die symbionten der blattiden im fettgewebe und ei insbesondere von Periplaneta orientalis. **104,** cxix, 53-66. **Fuhrmann, H.**—Beitrage zur kenntniss der hautsinnesorgane der tracheaten. Die antennalen sinnesorgane der myriapoden. **104,** cxix, 1-52. **Gerould, J. H.**—Blue-green caterpillars: The origin and ecology of a mutuation in hemolymph color in Colias philodice. **85,** xxxiv, 385-416. **Hollande, A. C.**—Reactions des tissus du Dytiscus marginalis. **87,** xlix, 543-63. **Lancefield & Metz.**—Non-disjunction and the chromosomes relationships of Drosophila willistoni. **119,** vii, 225-9. **Mallock, A.**—Metallic colouring of beetles. **76,** cviii, 432-3. **Monnot, E.**—Le mechanisme du saut chez les Elaterides. (Bul. Soc. Sc. et Med. Ouest, xxviii, 17-37; xxix, 19-28.) **Sturtevant, A. H.**—A case of rearrangement of genes in Drosophila. **119,** vii, 235-7. **Szymanski, J. S.**—Die sogenannte tierische hypnose bei einer insektenart. (Pfluger's Archiv..., clxvi, 528-30.) **Tanzer, E.**—Die zellkerne einiger dipterenlarven und ihre entwicklung. **104,** cxix, 114-53. **Wade, J. S.**—Notes on defensive scent glands of certain Coleoptera. **5,** xxviii, 145-9. **Zeleny, C.**—Decrease in sexual dimorphism of bar-eye Drosophila during the course of selection for low and high facet number. **90,** lv, 404-11.

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Cockerell, T. D. A.—Western bees obtained by the American museum expeditions. (American Mus. Novitates No. 24.) **Wells & Metcalf.**—A new species of oak gall and its maker. **4,** lii, 212-13.

On January 14, 1920 (although dated 1919), there appeared the first part of CONTRIBUTIONS TOWARD A MONOGRAPH OF THE SUCKING LICE by GORDON FLOYD FERRIS, then Instructor, now Assistant Professor of Entomology at the Leland Stanford Junior University and published by that institution. It was announced to be the first of a series which, when complete, will constitute a monograph of the Anoplura, and that the sequence in which the various genera would be dealt with would be governed entirely by convenience and relative completeness of material. The collection forming the basis of the work, presumably that at Stanford, is stated to be without a doubt the largest and most comprehensive now in existence, containing approximately three-fourths of the described species. The most significant portion of it has been obtained by the examination of the mammal skins in certain museums. This first part consisted of 51 octavo pages and 32 text figures and treated of the genera *Enderleinellus* and *Microphthirus*. The second part appeared in 1921, as Vol. II, No. 2 of the Stanford University Publications, University Series, Biological Sciences. It occupies 76 pages, contains 57 text figures and is concerned only with the genus *Hoplopleura*. Part I states that all discussion of the group as a whole and all keys to the families and genera must of necessity be delayed until the final papers of the series, which will also contain a complete host list, a bibliography, acknowledgments of the sources of material and other matter of general interest.

OBITUARY.

VICTOR SZEPLIGETI.

Thanks to Dr. K. Kertesz, I am now able to contribute the following obituary of Victor Szépligeti. Born in Zircz (Hungary) August 21, 1855, he died in his 60th year on March 24, 1915. He studied at the University and Technical University at Budapest. He became professor of Natural History and Chemistry in 1877. He taught until 1912 when he retired.

First he was a botanist and had a very large and precious herbarium (now in the Botanical Department of the Hungarian National Museum.) Then he was interested in Aphids and galls. Later he began to collect and study the Braconidae and Ichneumonidae.

Up to the time of his death he had published sixty papers which, with but three or four exceptions, dealt with Ichneumonoidea.

He published one paper on Cecidomyidae (Diptera) in 1899.

From 1883 to 1895 he published three papers that relate to Diptera or other insects either wholly or in part.

In *Rovartani Lapok*, Vol. 22, 1915, pp. 141-147, is a portrait, obituary and bibliography. The latter lists his publications except the posthumous ones. The obituary notice of nearly two pages is in Hungarian.

H. L. Viereck.

Caroline Burling Thompson.

Miss Caroline Burling Thompson, professor of zoology at Wellesley College, Wellesley, Massachusetts, died at that place December 5, 1921. She was born in Germantown, Philadelphia, Pennsylvania, June 27, 1869, daughter of Lucius P. and Caroline Burling Thompson. She attended the University of Pennsylvania, receiving the degrees of B.S. in Biology in 1898 and of Ph.D. in 1901. Under the influence of the late T. H. Montgomery, Jr. (then Assistant Professor), she, as a graduate, took up the study of the Nemertean worms and published at least three papers on this group. One of them, her thesis for the doctorate, on the anatomy of *Zygeupolia litoralis*, appeared in the *Proceedings of the Academy of Natural Sciences of Philadelphia* for 1901.

In 1901 she was appointed Instructor in Zoology at Wellesley College and was subsequently promoted to be Associate Professor (1909) and Professor (1916) in that subject. It was while there that Dr. Thompson's entomological work began with her comparative study of ants' brains, a subject "suggested to me by Prof. W. M. Wheeler of Harvard University as one that needed investigation." Her detailed description of the structure of this organ afforded, she believed, additional evidence that the mushroom bodies are the chief motor and psychic centers and that the queen's brain seems to represent the generalized type from which the worker caste has departed. (1913.) Extending her studies to termites, to compare their brains with those of ants, she found that "The termite brain as a whole is very similar in structure to the brain of ants, with the notable exception of the mushroom bodies which are of a much more simple and primitive type" and suggested that the frontal gland, found in all castes of termites, "may have

arisen phylogenetically from the ancestral median ocellus which is now lacking in the termites" (1916).

Her most important paper is that dealing with the origin of the castes of the common termite (1917). In it, after reviewing the views held as to the influence of food on differentiation of the various forms as well as the doubts expressed by others, she produced evidence that there are visible internal differences between the newly hatched young which are to develop into the reproductive and non-reproductive members of the community respectively, although externally they are all alike. "Therefore the fertile and sterile types are predetermined at the time of hatching," * * * * "My final conclusion is that all termite castes are predetermined in the egg." She was careful to point out the bearing of this discovery and the similar observations of Bugnion (1912, 1913) on "the greater question whether the heritable bodily structure is determined by extrinsic factors, such as food and environment, or by intrinsic factors within the germplasm." In two other papers (1919, 1920) additional confirmatory evidence in support of the germinal predetermination theory was furnished. In conjunction with Mr. T. E. Snyder, of the United States Bureau of Entomology, she discussed the question whether the phylogenetic origin of termite castes (1919) could be referred to continuous or discontinuous variations, without, however, reaching a definite conclusion.

Mr. Snyder has published a sympathetic notice of her abilities as a teacher and an investigator in *Science* for January 13, 1922, which the present writer heartily endorses. His acquaintance with her dates from her first appearance as a student at the University of Pennsylvania and he has followed her work on the termites especially with the greatest interest and pride in her achievements. Oh that she had lived longer and carried out her plans for similar work on the honey bee!

PHILIP P. CALVERT.

A list of Dr. Thompson's entomological papers follows:

1913. A Comparative Study of the Brains of three Genera of Ants, with special reference to the Mushroom Bodies. Journ. Comp. Neur., Phila., 23, 515-572.

1914. The Posterior Roots of the Mushroom Bodies in the Worker of *Bombus* sp. Op. cit. 24:283-289.

1916. The Brain and the Frontal Gland of the Castes of the "White Ant," *Leucotermes flavipes* Kollar. Journ. Comp. Neurol., 26:553-602.

1917. Origin of the Castes of the Common Termite, *Leucotermes flavipes*. Journ. Morphol., Phila., 30:83-106.

1918. Dual Queens in a Colony of Honey Bees. Science, N. York, 48:294-5.

*1919. The Question of the Phylogenetic Origin of Termite Castes. Biol. Bull., Woods Hole, 36:115-132.

1919. The Development of the Castes of Nine Genera and Thirteen Species of Termites. Op. cit. 36:379-398.

*1920. The "Third Form," the Wingless Reproductive Type of Termites: *Reticulitermes* and *Prorhinotermes*. Journ. Morph. 34: 591-632.

Papers marked with a (*) were written conjointly with Mr. T. E. Snyder.

Doings of Societies.

The Entomological Society of America.

At its recent meeting in Toronto in December, the Society elected the following officers and committees for 1922:

President, Arthur Gibson, Dominion Entomologist, Ottawa, Canada. *First Vice-President*, Dr. W. A. Riley, University of Minnesota, St. Paul. *Second Vice-President*, Professor R. A. Cooley, University of Montana, Bozeman, Mont. *Secretary-Treasurer*, Dr. C. L. Metcalf, University of Illinois, Urbana, Ill.

Additional Members of the Executive Committee—Dr. J. M. Aldrich, United States National Museum, Washington. Mr. Wm. T. Davis, New Brighton, N. Y. Dr. E. M. Walker, University of Toronto, Toronto, Ontario. Dr. O. A. Johannsen, Cornell University, Ithaca, N. Y.

Managing Editor of the Annals, Dr. Herbert Osborn, Ohio State University, Columbus, Ohio. *Assistant Managing Editor*, Dr. C. H. Kennedy, Ohio State University, Columbus, Ohio.

Editorial Board—Dr. W. S. Marshall, University of Wisconsin, Madison, Wis. Dr. Vernon L. Kellogg, National Research Council, Washington, D. C. Dr. F. E. Lutz, American Museum of Natural History, New York City. Dr. Wm. M. Wheeler, Bussey Institution, Boston 30, Mass. Dr. E. M. Walker, University of Toronto, Toronto, Ontario. Dr. S. A. Forbes, University of Illinois, Urbana, Ill. Dr. A. D. Hopkins, Bureau of Entomology, Washington, D. C. Prof. A. L. Lovett, Oregon Agricultural College, Corvallis, Ore. Dr. Frederick C. Muir, H. S. P. A. Experiment Station, Hawaii.

C. L. METCALF, *Secretary-Treasurer.*

EXCHANGES

This column is intended only for wants and exchanges, not for advertisements of goods for sale. Notices not exceeding three lines free to subscribers.

These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and only when necessary those at the top (being longest in) are discontinued.

Will collect Coleoptera, Lepidoptera, Hymenoptera, Diptera, etc., of the Chilean region. M. René Martin, chez M. Montané-Aguilar, Villa Alemana, Valparaiso, Chile.

Tropical Butterflies will be given in exchange for Terias nicippe, Vanessa antiopa, Euchloe sara or any aberrant forms of Lepidoptera. Hal Newcomb, 804 Elizabeth St., Pasadena, Calif.

I will collect material in any order, region Isthmus of Tehuantepec and C. A. Correspondence from persons needing material invited. J. J. White, Ocotlan de Morelos, Oaxaca, Mexico.

Wanted.—Diabrotica longicornis Say. from all parts of its range; also any N. A. species of this genus new to my collection. Liberal exchange. K. F. Chamberlain, Cornwall Bridge, Connecticut.

Wanted.—Elateridae from the Southern and Western States; Adelocera, Melanotus, and Cardiophorus especially desired. Liberal exchange in other Coleoptera, or for cash. Edward D. Quirsfeld, Hillsdale, New Jersey.

Halticini wanted in exchange for Coleoptera or insects of other orders.—L. G. Gentner, 213 Bailey St., East Lansing, Mich.

For Exchange—A large number of the living pupae of European Sphingidae for the living pupae of American butterflies and moths. I. C. Cheesman, Curator of Insects, Zoological Society of London, Regents Park, London, N. W., England.

Wanted—Species of Homoptera, Hemiptera and Orthoptera not represented in my collection in exchange for duplicate material of these orders from South Dakota. List of duplicates on application. H. C. Severin, South Dakota State College, Brookings, South Dakota.

Buprestidae, Cleridae, and **Carabinae** wanted from U. S. or Buprestidae of the world. Will collect insects of any group (except Lepidoptera) in exchange or pay cash. Alan S. Nicolay, 416a Grand Ave., Brooklyn, New York.

For Exchange—A large number of live cocoons of Callosamia promethea, C. cynthia and P. cecropia for other pupae or Lepidoptera. D. C. Heim, Sunbury, Pa.

Wanted to Exchange—N. A. Coleoptera for same not in my collection. Carl Selinger, 4419 Dover St., Chicago, Ill.

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Sometime Fellow in Biology, Bryn Mawr College, and

PHILIP POWELL CALVERT

Professor of Zoology, University of Pennsylvania, Editor of Entomological News

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